Citation:

Murakami K, Okubo H, Sasaki S. No relation between intakes of calcium and dairy products and body mass index in Japanese women aged 18 to 20 years. *Nutrition*. 2006 May; 22 (5): 490-495.

PubMed ID: 16500081

Study Design:

Cross-Sectional Study

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

This study examined the associations between calcium intake and dairy products to body mass index (BMI) in young Japanese women.

Inclusion Criteria:

- Subjects were students who entered dietetic courses at 22 colleges and technical schools in three of the four main islands of Japan in April 1997
- For statistical analysis, female subjects who were 18 to 20 years of age (N=1,960) were selected.

Exclusion Criteria:

From the 1,960 subjects selected, the following women were excluded:

- Those receiving dietary counseling (N=33)
- Those with an extremely low or high reported energy intake (<775 or >3,950kcal per day, N=18)
- Those with missing information on variables used in the present study (N=6).

Description of Study Protocol:

Recruitment

Subjects were recruited from 22 colleges and technical schools in three of the four main islands of Japan in April 1997.

Design

Cross sectional study.

Dietary Intake/Dietary Assessment Methodology

- Dietary habits during the previous month were assessed by using a validated, self-administered diet history questionnaire (DHQ). Body weight and height were self-reported as part of the DHQ. BMI was computed as weight (kg) divided by the square of height (meters)
- Measurements of dietary intake for 147 food and beverage items, energy, protein, fat, carbohydrate, alcohol, dietary fiber, and calcium were calculated by using an ad hoc computer algorithm developed for the DHQ, which was based on the Standard Tables of Food Composition in Japan
- Intake from dietary supplements was not included in this study
- Dairy products consisted of full-fat, low-fat, and skimmed milk, sweetened and non-sweetened yogurt, cheese, cottage cheese, ice cream and coffee cream
- Pearson's correlation coefficient between DHQ and three-day diet records was 0.49 for calcium intake that was adjusted for energy intake by using a residual model among 47 women
- For dairy products (g per 1,000kcal), Spearman's correlation coefficient between DHQ and 16-day diet records was 0.52 among 92 women (unpublished observations, S. Sasaki, 2004)
- In the DHQ, subjects also reported their rate of eating (very slow, relatively slow, medium, relatively fast or very fast) and intentional dietary change (no, changed within one year, changed within three year or changed more than three years ago).

Blinding Used

Not reported.

Statistical Analysis

- Mean BMI ± standard error (SE) was calculated by quartiles of these variables
- The following were used as control variables for body weight in covariate and multivariate analyses for: Residential block, size of residential area, smoking, alcohol drinking, physical activity, experience of dieting, intentional dietary change, rate of eating, protein intake as percent of total energy, fat intake as percent of total energy, and dietary fiber intake. Percentage of energy intake from carbohydrate was not included due to co-linearity with percentage of energy intake from fat
- Linear trends with increasing levels of intakes of calcium and dairy products were tested by assigning each participant the median value for the category and modeling this value as a continuous variable. We also calculated the partial regression coefficient (β) and SE for intakes of calcium and dairy products by multiple regression analysis with BMI as the dependent variable, with adjustment for the potential confounding variables indicated above
- Power calculations were as followed. In a previous study, the size of the effect of calcium intake on BMI was -0.26kg/m^2 per 100mg per 1,000kcal increase in calcium intake. In this study, mean calcium intake ± standard deviation (SD) was 306±148mg per 1,000kcal and the SD of BMI was 2.6kg/m^2. Using these values, power calculations revealed that a sample of 532 women (133 women in each quartile category) was sufficient to demonstrate the expected difference (-0.89kg/m^2) between the highest and lowest quartile categories (excepted medians 477 and 136mg per 1,000kcal, respectively), with 80% power at the

α=0.05 significance level
- All P-values are two-tailed, and P<0.05 was considered statistically significant
- For analyses, subjects were categorized into quartiles according to the energy-adjusted intakes (per 1,000kcal) of calcium and dairy products
- All statistical analyses were performed with SAS 8.2 (SAS Institute, Cary, North Carolina, USA).

Data Collection Summary:

Dependent Variables

BMI, calculated from self reported values obtained in food questionnaires for height and weight.

Independent Variables

Dairy and calcium consumption per day obtained from food questionnaires

Control Variables

- Age
- Residential block
- Size of residential area
- Smoking
- Alcohol drinking
- Physical activity
- Experience of dieting
- Intentional dietary change
- Rate of eating
- Protein intake as percent of total energy
- Fat intake as percent of total energy
- Dietary fiber intake.

Data was obtained from food questionnaires and lifestyle questionnaires.

Description of Actual Data Sample:

- *Initial N:*
  - A total of 2063 students (2017 women and 46 men) participated in the survey (response rate 99.7%)
- *Attrition (final N):* 1,905 women
  - Men were excluded, and those women not ages 18-20 years
  - 33 women receiving dietary counseling were excluded
  - Six women with missing data on one or more of the key variables were excluded
  - 18 women with extremely high or low reported energy intake were excluded
  - Some subjects were in more than one analytic sample
- *Age:* 18-20 years
- *Ethnicity:* Not reported
- *Other relevant demographics:* Not described
- *Anthropometrics:*

- Height =157.9±5.2
- Weight =51.8±7.3
- BMI =20.8±2.6kg/m^2

- *Location:* National Institute of Health and Nutrition, Tokyo, Japan.

Summary of Results:

- Mean BMI ± standard deviation (SD) was 20.8±2.6kg/m^2
- Mean estimated intakes were 268±93mg per 1,000kcal for calcium and 80±63g per 1,000kcal for dairy products
- Intakes of calcium and dairy products were not significantly associated with BMI. Adjusted means in the lowest and highest quartiles were 20.7 and 20.8 for calcium, P for trend =0.48, and 20.6 and 20.6 for dairy products, P for trend =0.81
- These results were also observed after excluding 481 energy under- and over-reporters for calcium, 20.4 and 20.5, respectively, P for trend =0.73; and dairy products, 20.3 and 20.4, respectively, P for trend =0.73.

Other Findings

Adjusted mean ± SE of BMI according to quartiles of energy-adjusted intakes of calcium and dairy products with partial regression coefficients (β) and SE expressing changes in BMI for change in energy-adjusted intakes of calcium and dairy products (N=1,905)*

Variable	Quartiles of Intakes of Dairy Products‡				P for Trend†	β ± SE	P
	1(N=476)	2 (N=476)	3 (N=477)	4 (N=476)			
Dairy product intake (g per 1,000kcal)	19 (0-32)	49 (33-65)	86 (66-108)	141 (109-458)			
BMI (kg/m^2)	20.6±0.1	20.8±0.1	21.1±0.1	20.6±0.1	0.81	-0.0004±0.0001	0.71

BMI, body mass index; SE, standard error

* Adjusted for residential block (Kanto II, Hokkaido, and Tohoku; Kanto I; Tokai and Hokuriku; Kinki I; Kinki II; Chugoku; Shikoku; Kita-kyushu; and Minami-kyushu), size of residential area (city with population ≥1 million, city with population <1 million and town and village), current smoking (yes or no), alcohol drinking (yes or no), physical activity (sedentary or active), experience of dieting (yes or no), intentional dietary change (no, changed within one year, changed within three years or changed more than three years ago), rate of eating (very slow, relatively slow, medium, relatively fast or very fast), protein intake (percentage of energy, continuous), fat intake (percentage of energy, continuous), and dietary fiber intake (g per 1,000kcal, continuous).

† Tests for linear trend used the median value in each quartile as a continuous variable in linear regression.
‡ Values are medians (ranges) or means ± SE.

Author Conclusion:

Intakes of calcium and dairy products may not necessarily be associated with BMI among young Japanese women who not only are relatively lean, but also have a relatively low intake of calcium and dairy products.

Reviewer Comments:

- *This was a well designed and implemented cross sectional study with a significant sample size*
- *The subjects in this study had relatively low BMI (mean: 20.8kg/m^2) and low intakes of calcium and dairy.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes

2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	No
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	Yes
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	???
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	???

5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	N/A
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	???
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	N/A
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes

7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	Yes
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes